# Help in the Kitchen: Grasping Cutlery using a Universal Robot

Project proposal

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## 1 Introduction

The use of robots is steadily increasing. One of the basic tasks that a robot can do is to pick and place objects. Usually, this requires that the objects are in particular positions and orientations. One of the current works at our lab is to make this pick and place task more flexible and robust by not requiring these precise object positions and orientations.

# 2 Goals

In this project we will solve the task of picking mixed cutlery from a box and placing the spoons, forks and knifes in three different boxes. It involves several important sub-tasks, such as, object detection (identify the cutlery in the image), recognition (which type of cutlery is this?), pose detection (position and orientation of the object in 3D space), motion planing (move the robot arm) and finally, grasping (how to position the robot gripper to be able to pick a particular object). Then, the robot will move the picked object into one of 3 boxes, depending on its type. We have already developed code for most of these tasks [2].



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The work will be done in Linux using ROS (Robot Operative System), Movelt[1] and Python 3. We will make tests using a real robot, the Universal Robot UR3.

#### 3 Tasks

The project has the following tasks:

- 1. Introduction to robotics with ROS (3 weeks);
- 2. Study and test the existing Movelt code (4 weeks);
- Implement new code on simulation and on the robot, and analyze its results (6 weeks);
- 4. Write the project's report (2 weeks).

### 4 Technical and Academic Requirements

It is desirable that the student has grades above 13 on the following courses: Estruturas de Dados, Probabilidades e Estatística, Inteligência Artificial.

#### 5 Expected Results

- Source code and documentation of all code developed;
- Project report.

#### References

- David Coleman, Ioan Alexandru Sucan, Sachin Chitta, and Nikolaus Correll. Reducing the barrier to entry of complex robotic software: a moveit! case study. *CoRR*, abs/1404.3785, 2014.
- [2] Nuno Pereira and Luís A. Alexandre. Maskedfusion: Mask-based 6d object pose detection. *CoRR*, abs/1911.07771, 2019.